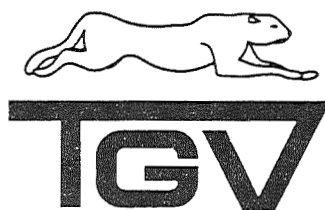


N91-27020

***MultiNet TCP/IP***  
***for***  
***VAX/VMS***  
***Update***

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### ***MultiNet TCP/IP for VAX/VMS Update***

- Multi-protocol networking services (TCP/IP, CHAOSnet, PUP) for VAX/VMS computer systems
- Currently shipping ***MultiNet V2.2***
- Single kit for VMS V4.5 - V5.4
- All DEC supported VAX/VMS configurations

## ***Device Support***

### **Ethernet**

- All Digital controllers
- CMC ENP family in link mode
- Excelan/Novell EXOS family (except BI board) in link mode
- Interlan NI1010
- Xerox 2.94 Mbps Ethernet

### **Other Technologies**

- NSC Hyperchannel
- Shared Proteon proNET-10, 80
- X.25 - ACC 5250/6250
- T1/HDLC - ACC 5100/6100
- DMR-11, DMV-11 (IP over DDCMP)
- SLIP - using any VMS terminal line

## ***DECnet Interoperability***

- DECnet over IP; encapsulates DECnet datagrams in UDP datagrams (appears to DECnet as a point-to-point link between DMR-11 interfaces)
- IP over DECnet
  - Kernel implementation — transmits IP datagrams over a DECnet link in the networking kernel by calling NETDRIVER at the ALTSTART entry point
  - Dbridge
    - \* Transmits IP datagrams over a DECnet link via a user process using \$QIO reads/writes
    - \* Interoperable with WIN/TCP and Fusion Dbridge implementations

## *Installation*

- VMSINSTAL - painless
  - 99% of configurations supported
  - 15 minutes or less on most newer systems
- Configuration utilities
  - Handle all aspects of network configuration and operation
  - Perform sanity checks to ensure viable configuration
  - Automatically generate all startup command files
  - Utilities:
    - Network/devices
    - Remote printer queues
    - Services
    - DECnet over IP
    - Client and Server NFS

## ***MultiNet Services***

- Although servers may listen on their own for service requests, the Master Server provides an easier way of invoking services
- Inbound connection requests handled by Master Server (configured by the server configuration utility)
- Accepts or rejects connection; if it accepts, it either:
  - Performs the service internally, or
  - Creates a server process and passes the connection on SYS\$INPUT, SYS\$OUTPUT, ...
- Can restrict access on source host or net address on a per-service basis
- Keep an audit trail of attempted, accepted, and rejected requests on a per-service basis
- Sites can provide locally written Auditing code
- Internal servers may be linked in or dynamically loaded from shareable images

## ***Domain Name Server***

- BIND 4.8.1 + Partial Asynchronous Zone Transfers
- Runs internal to Master Server
- NSLOOKUP provided
- If Domain Name System (DNS) query fails, or DNS not enabled, lookups use host tables compiled using a perfect hashing scheme

## ***Routing Protocols***

- GATED 1.9.1.7
- Runs internal to Master Server
- Supports RIP, EGP, HELLO

## *Telnet*

- Direct connection between VMS terminal driver and network kernel
  - Overhead about the same as a DZ-11
  - No process involved, so no context switching
- Virtual terminals supported
- Negotiations
  - Terminal type (SMG)
  - Window size
  - Baud rate
  - Flow control (negotiated local by default)
  - TN3270 automatic recognition
- No inherent limit on number of incoming connections; customer running with 150 connections into a VAX 6230
- Optional switches to bypass newer option negotiation features for compatibility with other broken Telnet implementations (antique-mode)



## ***FTP***

- Hybrid server
  - Initially runs internal to Master Server
  - When USER and PASS are received, LOGINOUT is invoked to validate, initialize, and run the FTP server process
- Supports all VMS security features:
  - ACLs (not just UIC ACLs)
  - Accounting
  - Auditing
  - Breakin detection and evasion
  - Security alarms
- Runs SYLOGIN.COM, LOGIN.COM
- Creates FTP\_SERVER.LOG file in login directory with log of transactions
- STRU O VMS
  - Transparent VMS-VMS transfer of all VMS file types
  - Automatically negotiated
  - Fast, no reformatting needed
- Record structure also supported
- Performance:
  - MicroVAX II can saturate DEC Ethernet interfaces

## ***SMTP***

- Uses VMS Mail foreign protocol interface:  
SMTP%"user@node"
- Enqueueing done with VMS server queue  
(using VMS queue management)
- MX support
- Tries all IP address found via "A" records  
until successful
- Incoming and outgoing mail enqueued  
(allows incoming mail to be forwarded  
to an unavailable DECnet node)
- MM-32 user interface bundled with  
***MultiNet***
- VMS Mail SET FORWARD and SET  
PERSONAL-NAME supported
- Supports outbound cluster (or  
organizational) alias
- PMDF supported as alternative (fully  
functional email gateway)

## ***DECwindows over TCP/IP***

- DECwindows over TCP/IP support provided by emulation of the VMS/ULTRIX Connection (UCX) \$QIO interface
- Looked into using DECwindows transport layer interface, but decided to do UCX \$QIO emulation as a more general solution (to support other applications written to run over UCX)

## ***BSD "r" Services***

- RLOGIN — remote terminal protocol
- RSHELL/REXEC — remote command execution
- RCP — remote copy protocol
- RMT — remote access to VMS tape drives
- Each uses "r" services authentication  
(HOSTS.EQUIV and .RHOSTS)

## ***Remote Printing***

- LPD protocol client and server
  - Integrated with VMS queueing system
  - UNIX machines can print on VMS printers
  - VMS systems can print on UNIX printers via a VMS print queue (symbiont and spooled pseudo-device)
- Stream-mode symbiont sends print jobs directly to remote TCP port (useful for printers connected to terminal servers)
- Controlled by printer configuration utility
- Supports VMS accounting
- User definable */etc/printcap* to VMS print queue attribute mapping

## ***RPC Services and NFS Server***

- Full UNIX filesystem semantics mapped to VMS filesystem
- Respects VMS diskquotas
- VMS text files are converted to UNIX stream format for access from NFS clients
- Cache to mask VMS bottlenecks
- Supports all ODS-2 VMS volumes:
  - Shadow sets
  - Bound volumes
  - DFS served disks
- Very high performance
  - Multi-threaded so performance not degraded by multiple clients
  - Runs in the kernel, so no process context overhead involved
  - Uses a special XDR serializer

## ***NFS Client***

- Transparent file access to NFS servers from VAX/VMS systems
- Emulates Files-11 ODS-2 XQP, presenting virtually all of the VMS file system semantics
- Supports arbitrary RMS file/record types with text files mapped to RMS Stream\_LF record type
- Performance, even with majority of code in process for debugging, is good (within a factor of 3 of a local disk)

## ***NETCONTROL***

- Allows privileged users to control servers running internal to the Master Server
- Can be used to control both local and remote machines (using ***MultiNet*** security features)
- MULTINET NETCONTROL /HOST=TGV.COM  
NFS RESTART



## ***Diagnostics***

- PING – uses ICMP packets to determine reachability, packet loss, round trip timing
- TRACEROUTE – trace route of a host through an IP network
- TCPDUMP – Ethernet protocol analysis

## ***Programming Support***

- Shareable 4.3BSD UNIX compatible socket library
- Programmer's kit separately installed (MNETLIB)
- Hardcopy Programmer's Guide and extensive online HELP information
- MultiNet \$QIO (compatible with WIN/TCP), EXOS compatible \$QIO, and UCX compatible \$QIO interfaces supported
- RPC programming library

## ***Miscellaneous Features***

- FINGER
- WHOIS client
- NETSTAT
- SYSTAT
- TFTP
- BOOTP
- RARP
- NTP
- TALK/NTALK
- BBOARD
- RUSERS
- RWALL
- REMIND
- CHARGEN
- DAYTIME
- TIME
- DISCARD
- ECHO
- RPCQUOTA

## ***MultiNet* Futures**

- Kerberos
  - ticket server
  - kinit
  - klist
  - kdestroy
  - Kerberized Telnet and FTP
- ALL-IN-1/Message Router to SMTP gateway capability
- VMS NFS Client to VMS NFS Server support
- Performance enhancements in NFS Client and Server

## ***MultiNet* Futures**

- Support for booting diskless Sun workstations and DECstations
- Full support for VAX-11 C runtime socket library (run UCX applications unmodified over ***MultiNet***)
- GATED V2.0 - EGP, RIP, HELLO, BGP
- BIND 4.8.3
- POP2 Mail Server (possibly more)

## ***MultiNet* Futures**

- select() supported in ***MultiNet*** socket library
- ISODE — OSI applications over TCP/IP
- XVIEW toolkit and OPEN LOOK Window Manager under VAX/VMS and DECwindows
- SNMP network management station under VAX/VMS
- Command line recall and editing !!!